

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
16 November 2000 (16.11.2000)

PCT

(10) International Publication Number
WO 00/67907 A3

(51) International Patent Classification⁷: **B01L 3/00**,
B01J 19/16, G01N 1/34

(21) International Application Number: PCT/US00/12826

(22) International Filing Date: 10 May 2000 (10.05.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/133,448 11 May 1999 (11.05.1999) US
60/140,180 18 June 1999 (18.06.1999) US
09/470,677 23 December 1999 (23.12.1999) US

(71) Applicant: **ACLARA BIOSCIENCES, INC.** [US/US];
1288 Pear Avenue, Mountain View, CA 94043-1432 (US).

(72) Inventors: **SINGH, Sharat**; 3420 Royal Meadow Lane,
San Jose, CA 95135 (US). **ULLMAN, Edwin**; 135 Selby
Lane, Atherton, CA 94027 (US). **GIBBONS, Ian**; 831
La Mesa Drive, Portola Valley, CA 94028 (US). **BOONE,**

Travis; 300 Monta Vista Avenue #305, Oakland, CA 94611
(US). **XIAO, Vivian**; 1556 Oyama Drive, San Jose, CA
95131 (US). **BJORNSON, Torlief**; 7030 Daniel Court,
Gilroy, CA 95020 (US). **HOOPER, Herbert**; 823 Covington
Street, Belmont, CA 94002 (US).

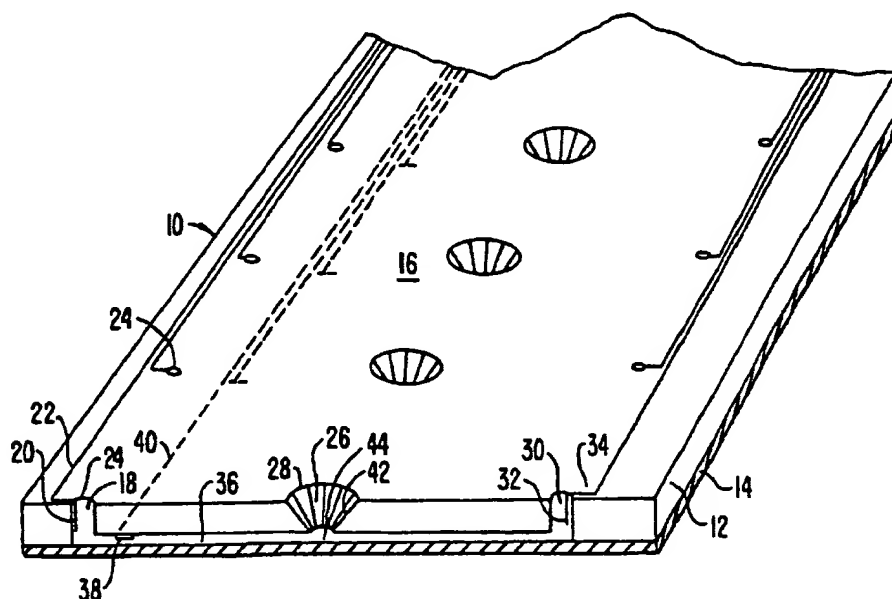
(74) Agents: **RAE-VENTER, Barbara et al.**; Rae-Venter Law
Group, P.C., P.O. Box 60039, Palo Alto, CA 94306 (US).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE,
DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU,
ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS,
LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ,
PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT,
TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent
(AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent
(AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU,
MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM,
GA, GN, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: **SAMPLE EVAPORATIVE CONTROL**



(57) Abstract: Devices and methods are provided using microfluidic devices for manipulating small volumes and determining a variety of chemical and physical events. The devices rely upon an opening to the atmosphere of a small volume in a zone, where a sample is placed in the zone where evaporation can occur. The zone is maintained in contact with a liquid medium that serves to replenish the liquid in the zone and maintain the composition of the mixture in the zone substantially constant. The diffusion of components in the zone is restricted during the course of the determination by the liquid flux into the zone.

WO 00/67907 A3

**Published:**

- With international search report.
- Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(88) Date of publication of the international search report:

8 February 2001

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/12826

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B01L3/00 B01J19/16 G01N1/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B01L B01J G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|-----------------------|
| X | WO 98 33052 A (LITBORN ERIK ; ROERADE JOHAN (SE)) 30 July 1998 (1998-07-30) cited in the application page 1, line 1 - page 3, line 6 page 3, line 26 - page 4, line 5; figures 1,2B --- | 1,2,11, 18 |
| T | LITBORN ET AL.: "parallel reactions in open-chip based nanovials with compensation for solvent evaporation" ELECTROPHORESIS, 2000, pages 91-99, XP000934274 de the whole document --- | 1,2,11, 18 |
| X | US 5 593 838 A (ZANZUCCHI PETER J ET AL) 14 January 1997 (1997-01-14) --- | 20,24,36 |
| A | column 12, line 35 - line 56; figures 7,8 --- | 37 |
| | -/-- | |

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *Z* document member of the same patent family

Date of the actual completion of the international search

22 November 2000

Date of mailing of the international search report

29. 11. 00

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040. Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Hocquet, A

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|-----------------------|
| A | US 5 223 219 A (SUBRAMANIAN KUMAR ET AL) 29 June 1993 (1993-06-29) column 11, line 9 - line 21; figures 4-7 column 14, line 9 -column 15, line 3 column 17, line 6 - line 54 --- | 20,24, 36,37 |
| A | US 5 334 837 A (IKEDA MASAHIKO ET AL) 2 August 1994 (1994-08-02) abstract --- | 1 |
| A | WO 95 34374 A (BEHRINGWERKE AG) 21 December 1995 (1995-12-21) page 11, line 2 - line 31; figures --- | 1 |
| X | US 4 659 677 A (GLOVER CLYDE P ET AL) 21 April 1987 (1987-04-21) column 3, line 16 - line 32 column 5, line 23 -column 6, line 11; figure 8 --- | 28,29 |
| A | US 5 558 837 A (TSUKISHIMA CHIHIRO) 24 September 1996 (1996-09-24) column 15, line 19 -column 17, line 26; figures 15-19 --- | 28 |
| X | US 5 785 926 A (KRAFT RAY ET AL) 28 July 1998 (1998-07-28) column 6, line 41 -column 7, line 15; figures 6-10 column 9, line 3 - line 36; figure 18 --- | 28 |
| A | US 5 766 959 A (DASGUPTA PURNENDU K) 16 June 1998 (1998-06-16) column 4, line 24 - line 51; examples 44,45 column 5, line 11 - line 20 column 5, line 40 - line 42 --- | 28,29 |
| A | HANGHUI L ET AL: "Analytical chemistry in a drop" TRAC, TRENDS IN ANALYTICAL CHEMISTRY,GB,ANALYTICAL CHEMISTRY. CAMBRIDGE, vol. 15, no. 9, 1 October 1996 (1996-10-01), pages 468-475, XP004070366 ISSN: 0165-9936 page 471, column 2, paragraph 2; figure 4 --- | 19,28 |
| A | US 4 960 566 A (MOCHIDA EI) 2 October 1990 (1990-10-02) column 6, line 38 - line 41; figures --- | 30 |
| | --- -/-- | |

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/12826

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|-----------------------|
| P, X | WO 99 44746 A (NILSSON JOHAN ; LAURELL THOMAS (SE); NILSSON STAFFAN (SE); SANTESSO) 10 September 1999 (1999-09-10) page 16, line 10 - line 15; figure 3 page 6, line 1 - line 7 page 31, line 6 - page 32, line 20 page 36, line 4 - line 16 ----- | 19 |
| A | WO 97 01085 A (DROTT JOHAN ; NILSSON JOHAN (SE); LAURELL THOMAS (SE); NILSSON STAF) 9 January 1997 (1997-01-09) the whole document ----- | 19 |

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 00/12826

B x I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/SA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-10,11-17,18,20-23,24-27,31-32,33-35,36,37

method for performing operations in a liquid zone containing a solvent undergoing evaporation, the liquid zone being in a well open to atmosphere extending through a wall of a capillary channel, and devices.

2. Claims: 19,28-30

Method for performing a determination in a device comprising two capillaries with confronting orifices defining a liquid zone exposed to the atmosphere, and the device.

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter. Application No

PCT/US 00/12826

| Patent document cited in search report | | Publication date | Patent family member(s) | Publication date |
|---|---|---------------------|----------------------------|---------------------|
| WO 9833052 | A | 30-07-1998 | AU 5787998 A | 18-08-1998 |
| US 5593838 | A | 14-01-1997 | US 5585069 A | 17-12-1996 |
| | | | AU 705351 B | 20-05-1999 |
| | | | AU 4152396 A | 06-06-1996 |
| | | | AU 705659 B | 27-05-1999 |
| | | | AU 4233796 A | 06-06-1996 |
| | | | CA 2204912 A | 23-05-1996 |
| | | | CA 2205066 A | 23-05-1996 |
| | | | EP 0791238 A | 27-08-1997 |
| | | | EP 0808456 A | 26-11-1997 |
| | | | JP 11500602 T | 19-01-1999 |
| | | | WO 9615450 A | 23-05-1996 |
| | | | WO 9615576 A | 23-05-1996 |
| | | | US 5681484 A | 28-10-1997 |
| | | | US 5643738 A | 01-07-1997 |
| | | | US 5846396 A | 08-12-1998 |
| | | | US 5985119 A | 16-11-1999 |
| | | | US 5755942 A | 26-05-1998 |
| | | | US 5863708 A | 26-01-1999 |
| | | | US 5858804 A | 12-01-1999 |
| US 5223219 | A | 29-06-1993 | AU 3976793 A | 18-11-1993 |
| | | | CA 2109704 A | 28-10-1993 |
| | | | DE 69320437 D | 24-09-1998 |
| | | | DE 69320437 T | 11-02-1999 |
| | | | EP 0593714 A | 27-04-1994 |
| | | | ES 2123050 T | 01-01-1999 |
| | | | JP 2944216 B | 30-08-1999 |
| | | | JP 6509279 T | 20-10-1994 |
| | | | WO 9320939 A | 28-10-1993 |
| US 5334837 | A | 02-08-1994 | JP 5240785 A | 17-09-1993 |
| | | | JP 5312794 A | 22-11-1993 |
| | | | JP 6003267 A | 11-01-1994 |
| | | | JP 5099813 A | 23-04-1993 |
| | | | DE 4233231 A | 08-04-1993 |
| WO 9534374 | A | 21-12-1995 | AT 195266 T | 15-08-2000 |
| | | | CA 2192936 A | 21-12-1995 |
| | | | DE 69518321 D | 14-09-2000 |
| | | | EP 0764046 A | 26-03-1997 |
| | | | EP 0983788 A | 08-03-2000 |
| | | | JP 9510656 T | 28-10-1997 |
| US 4659677 | A | 21-04-1987 | CA 1229826 A | 01-12-1987 |
| | | | JP 60013260 A | 23-01-1985 |
| US 5558837 | A | 24-09-1996 | JP 7275690 A | 24-10-1995 |
| | | | DE 19503634 A | 19-10-1995 |
| | | | US 5707588 A | 13-01-1998 |
| US 5785926 | A | 28-07-1998 | NONE | |
| US 5766959 | A | 16-06-1998 | NONE | |
| US 4960566 | A | 02-10-1990 | JP 1884951 C | 10-11-1994 |
| | | | JP 6007918 B | 02-02-1994 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter. Application No

PCT/US 00/12826

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---------------------|----------------------------|---------------------|
| US 4960566 A | | JP 63069539 A | 29-03-1988 |
| | | AT 69892 T | 15-12-1991 |
| | | AU 582501 B | 23-03-1989 |
| | | AU 7737287 A | 17-03-1988 |
| | | CA 1289856 A | 01-10-1991 |
| | | DE 3774810 D | 09-01-1992 |
| | | EP 0260136 A | 16-03-1988 |
| | | ES 2028095 T | 01-07-1992 |
| WO 9944746 A | 10-09-1999 | AU 2635499 A | 20-09-1999 |
| WO 9701085 A | 09-01-1997 | AU 6246396 A | 22-01-1997 |
| | | CA 2224278 A | 09-01-1997 |
| | | EP 0835435 A | 15-04-1998 |
| | | JP 11508360 T | 21-07-1999 |